

THERMAL SIMULATION REPORT

Report Number:	TCL2014-SWA-015
Prepared For:	Steel Window Association 42 Heath Street Tamworth Staffordshire B79 7HJ
Door System Identifier:	W40
Lock Panel Frame Identifier	SWZ7
Meeting Rail Identifier:	SW5/SWX8
Vent Frame Identifier:	SW5
Outer Frame Identifier:	SW8
Glazing System:	4mm Planitherm One/4S – 8mm 90% Krypton – 4mm Planilux -8 mm 90% Krypton – 4mm Planitherm One/4S
Spacer Bar:	8mm Edgetech Super Spacer Standard with butyl secondary sealant
Notes:	Aluminium Bead Reference Drawing SWA-W40-013

Result

Thermal Transmittance (U_{Door})	1.5	W/(m ² K)
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(Door Configuration as defined in BS EN 14351-1 Annex E)
(2000mm wide x 2180 high – dual leaf)

Report Prepared By Dr Gary Morgan
Therm Consulting

Signed: *G. Morgan*

Date: 22nd May 2014

The simulations in this report were performed using Win IsoPro 7.80
strictly according to EN ISO 10077 – 2:2012
The files generated are attached to this report as appendices



**BFRC Certified
Simulator 016**

GENERAL WINDOW / DOOR U VALUE

Frame Elements

Frame Element (Name)	Area (mm ²)	Area (m ²)	Uframe	Sight Line Length (mm)	Sight Line Length (m)	Psi value	Area x Uf	Lengthx Psi	Total Heat Flow
Left Head	51813.086	0.051813	6.128	911.5	0.9115	0.0550	0.317511	0.0501325	0.367643093
Right Head	51408.084	0.051408	6.128	911.5	0.9115	0.0550	0.315029	0.0501325	0.365161237
Left Jamb	114804.23	0.114804	6.128	2072.0007	2.0720007	0.0550	0.70352	0.11396004	0.817480372
Right Jamb	114804.18	0.114804	6.128	2072.0007	2.0720007	0.0550	0.70352	0.11396004	0.817480047
Meeting Rail	146693.67	0.146694	6.442	1962	1.962	0.1020	0.945001	0.200124	1.145124594
Left Sill	51813.086	0.051813	6.128	911.5	0.9115	0.0550	0.317511	0.0501325	0.367643093
Right Sill	51408.084	0.051408	6.128	911.5	0.9115	0.0550	0.315029	0.0501325	0.365161237
Lock Panel Frame	20520.149	0.02052	6.434	546	0.546	0.0510	0.132027	0.027846	0.159872635
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0
		0				0	0	0	0

Note, when dealing with Transom or Mullion sections, take the average of both sight line dimensions.

Totals		0.603265							4.405566309
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Glazing

Glazing Pane	Area (mm ²)	Area (m ²)	Uglass	Area x Ug	Total Heat Flow
Left Glass	1852768.6	1.852769	0.602	1.115367	1.115366696
Right Glass	1888628.7	1.888629	0.602	1.136954	1.136954488
Lock Panel	15339.919	0.01534	0.709	0.010876	0.010876003
		0		0	0
		0		0	0
		0		0	0
		0		0	0
		0		0	0
Totals		3.756737			2.263197187

Overall Window / Door Dimensions

Height (mm)	2180
Width (mm)	2000

Total Window / Door Area m² = 4.36 Total Window / Door Area Calculated = 4.360002 % Error -0.00004128

Note - Both areas should match to better than 1%, if not, check figures carefully

Window / Door U value = 1.53

Version 11 23/10/2012. Calculations according to BS EN 673:2011

Number of spaces	Help					
2						
	Spaces		1		2	
Glazing orientation						
	Vertical					
Resistivity panes	1	m·K/W	P a n e 1		P a n e 2	
	Outside		90%		90%	
Emissivities						
Calculate			Gas		Gas	
			Krypton		Krypton	
Thickness (mm)	4.0		8		8	
Normal emissivity			0.01		0.89	
$\sum d_j \cdot r_j =$	0.052		Uncoated		Uncoated	

For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.837

Iteration number	U value	$\sum 1/h_s$	λ_{eff}	ΔT	λ_{eff}	ΔT
	W/(m ² ·K)	(m ² ·K)/W	W/(mK)		W/(mK)	
1	0.602	1.4398	0.0111	7.5	0.0111	7.5
2	0.602	1.4398	0.0111	7.5	0.0111	7.5

Simulation software: WinIso2D 7.80

Date: 21.05.2014

File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Lock Panel.f2d



Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 200,00 x 54,99 mm

Number of elements in simulation model: X-direction: 100; Y-direction: 28



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 2,838 W/m

2D thermal conductance L_{2D} : 0,142 W/mK

Length top/left: 200,00 mm

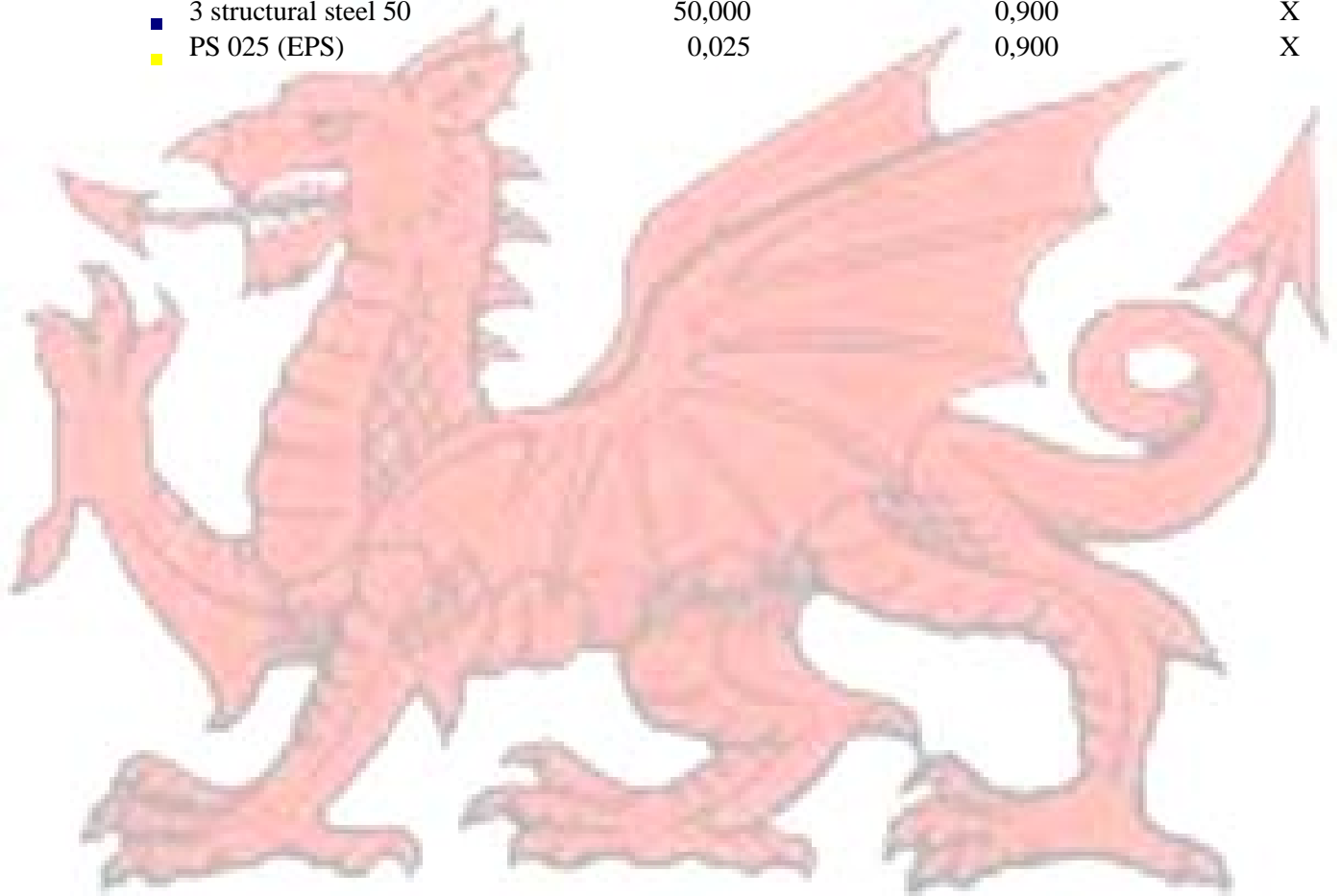
U-value top/left: 0,709 W/m²K

Length bottom/right: 0,00 mm

U-value bottom/right: 0,000 W/m²K

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
■ 1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-2,838	X
■ 1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	2,838	X
Material	L (W/mK)	Emiss		10077 konform
■ 3 structural steel 50	50,000	0,900		X
■ PS 025 (EPS)	0,025	0,900		X



Simulation software: WinIso2D 7.80

Date: 22.05.2014

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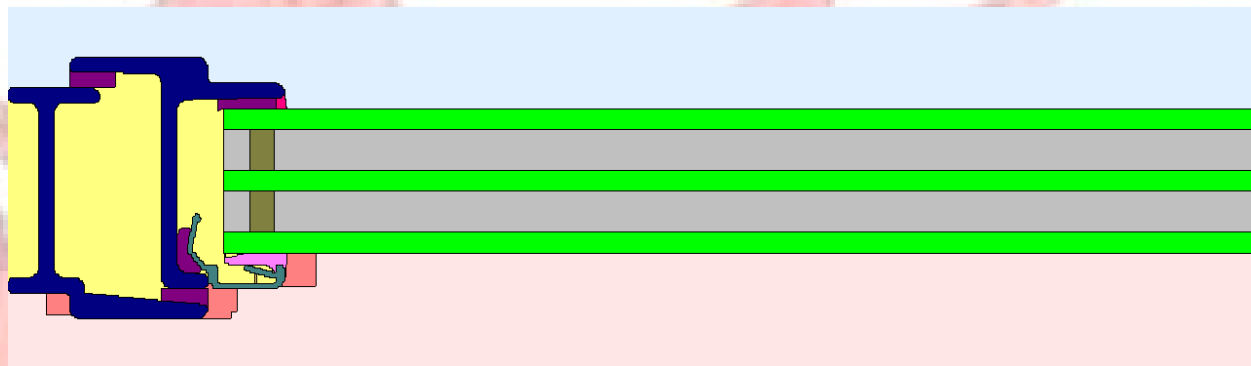


Calculation of the linear thermal transmission coefficient Ψ according to EN ISO 10077-2

Simulation model:

Dimensions (width x height): 243,99 x 70,90 mm

Number of elements in simulation model: X-direction: 217; Y-direction: 131



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 10,005 W/m

2D thermal conductance L_{2D} : 0,500 W/mK

Length top/left: 190,00 mm

U-value top/left: 0,602 W/m²K

Length bottom/right: 0,00 mm

U-value bottom/right: 0,000 W/m²K

Ψ -value: 0,055 W/mK

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	7,755	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-10,005	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,250	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80

Date: 22.05.2014

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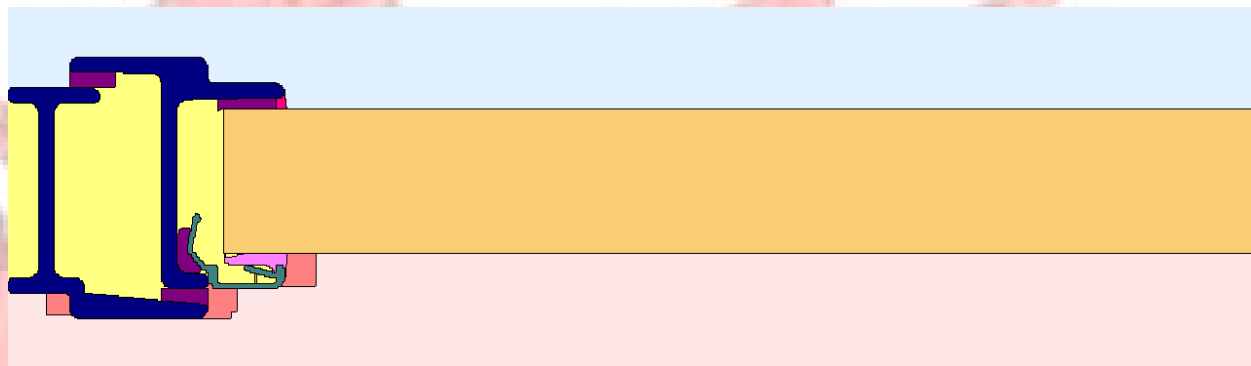


Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 243,99 x 70,90 mm

Number of elements in simulation model: X-direction: 217; Y-direction: 131



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 10,536 W/m

2D thermal conductance $L2D$: 0,527 W/mK

Length 1: 190,00 mm

U-value 1: 1,031 W/m²K

Length 2: 0,00 mm

U-value 2: 0,000 W/m²K

U_f -value: 6,128 W/m²K

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	7,755	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-10,005	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,250	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80

Date: 22.05.2014

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Calculation of the linear thermal transmission coefficient Ψ according to EN ISO 10077-2

Simulation model:

Dimensions (width x height): 245,09 x 60,00 mm

Number of elements in simulation model: X-direction: 202; Y-direction: 85



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 10,383 W/m

2D thermal conductance L_{2D} : 0,519 W/mK

Length top/left: 190,00 mm

U-value top/left: 0,602 W/m²K

Length bottom/right: 0,00 mm

U-value bottom/right: 0,000 W/m²K

Ψ -value: 0,051 W/mK

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	9,683	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-10,383	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	0,700	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0108	0,011	0,900	-
PS 025 (EPS)	0,025	0,900	-

Simulation software: WinIso2D 7.80

Date: 22.05.2014

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Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 245,09 x 60,00 mm

Number of elements in simulation model: X-direction: 202; Y-direction: 85



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 10,995 W/m

2D thermal conductance $L2D$: 0,550 W/mK

Length 1: 190,00 mm

U-value 1: 1,031 W/m²K

Length 2: 0,00 mm

U-value 2: 0,000 W/m²K

U_f -value: 6,434 W/m²K

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	9,683	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-10,383	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	0,700	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0108	0,011	0,900	-
PS 025 (EPS)	0,025	0,900	-

Simulation software: WinIso2D 7.80

Date: 22.05.2014

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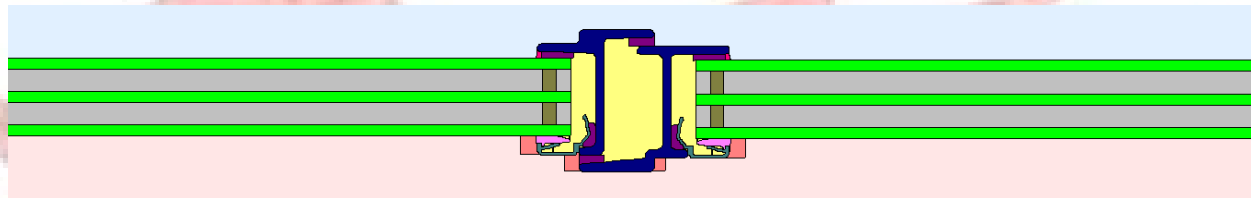


Calculation of the linear thermal transmission coefficient Ψ according to EN ISO 10077-2

Simulation model:

Dimensions (width x height): 448,98 x 69,99 mm

Number of elements in simulation model: X-direction: 356; Y-direction: 142



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 15,513 W/m

2D thermal conductance L_{2D} : 0,776 W/mK

Length top/left: 190,00 mm

U-value top/left: 0,602 W/m²K

Length bottom/right: 190,00 mm

U-value bottom/right: 0,602 W/m²K

Ψ -value: 0,102 W/mK

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	12,642	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-15,513	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,871	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0108	0,011	0,900	-
PS 025 (EPS)	0,025	0,900	-

Simulation software: WinIso2D 7.80

Date: 22.05.2014

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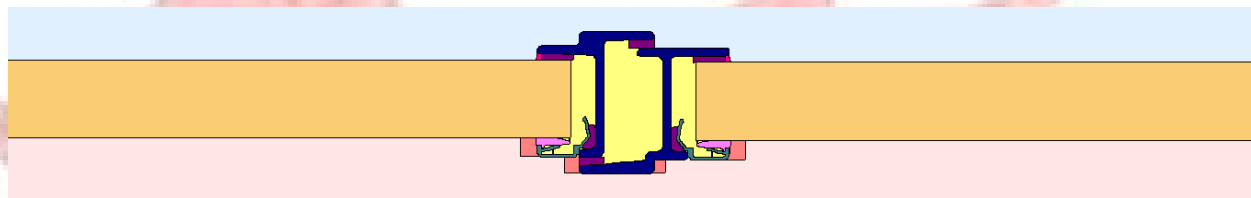


Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 448,98 x 69,99 mm

Number of elements in simulation model: X-direction: 356; Y-direction: 142



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 16,725 W/m

2D thermal conductance L_{2D} : 0,836 W/mK

Length 1: 190,00 mm

U-value 1: 1,031 W/m²K

Length 2: 190,00 mm

U-value 2: 1,031 W/m²K

U_f -value: 6,442 W/m²K

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	12,642	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-15,513	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,871	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0108	0,011	0,900	-
PS 025 (EPS)	0,025	0,900	-